

# The Pan-Pacific Entomologist

VOL. 50

APRIL 1974

No. 2

## A New Genus of Ochodaeinae and a Description of the Larva of *Pseudochodaeus estriatus* (Schaeffer)

(Coleoptera: Scarabacidae)<sup>1</sup>

DAVID C. CARLSON AND PAUL O. RITCHER

*Department of Entomology*

*Oregon State University, Corvallis 97331*

Schaeffer (1906) described *Ochodaeus estriatus* based on a single specimen from California. From his comments it is clear that he considered the species different enough from other *Ochodaeus* to warrant placement in another genus. He did not do so solely because he had only the one specimen and did not wish to dissect it.

Since 1906, additional specimens of *Ochodaeus estriatus* have been taken in California and Oregon. Study of their morphology indicates that Schaeffer was indeed correct in his original conclusions. We hereby erect the new genus *Pseudochodaeus* for Schaeffer's species.

### **Pseudochodaeus** New Genus

TYPE SPECIES.—*Ochodaeus estriatus* Schaeffer, 1906, p. 271; monobasic.

DESCRIPTION.—Body elongate, convex; head, pronotum, and elytra densely setose; ventral surfaces and legs clothed with longer setae. Head transverse; mandibles and labrum visible from above; labrum transverse, densely setose and very shallowly emarginate anteriorly; anterior clypeal margin strongly reflexed. Antennae 10-segmented, first segment triangular, densely setose; club with eighth segment enlarged and cupped, receiving segments 9 and 10 (Fig. 5). Eyes not divided by ocular canthus. Pronotum subquadrate, evenly convex except for shallow, median longitudinal impression; anterior margin shallowly and evenly indented; posterior margin sinuate on each side of midline; marginal bead entire. Scutellum setose and punctate, rounded posteriorly. Elytra long, apex of abdomen not visible from above; posterior sutural angle simple, not dentate; 1 punctate stria between median suture and humeral umbone, this stria close to median suture, becoming confluent with median suture at elytral declivity. Propygidium simple, not modified to accept apex of elytra. Pygidium and 6 visible abdominal sternites densely setose; sternites free, not connate, fifth sternite lacking stridulatory peg. Foretibia tridentate, teeth well developed. Outer apical spur on meso- and metatibia pectinate; meta-trochanter produced beyond posterior edge of femur into sharp projection. Male

<sup>1</sup>The financial support of the National Science Foundation (Grants GB-3586, GB-6194X, and GB-31129) and of the Oregon Agricultural Experiment Station is gratefully acknowledged. Oregon Agricultural Experiment Station, Technical Paper No. 3786.

genitalia (Figs. 1-3): proximal end of basal piece tapering to point; parameres symmetrical, lacking basal elongate process; V-shaped apophysis present; aedeagal sac well developed, bearing numerous sclerotized structures.

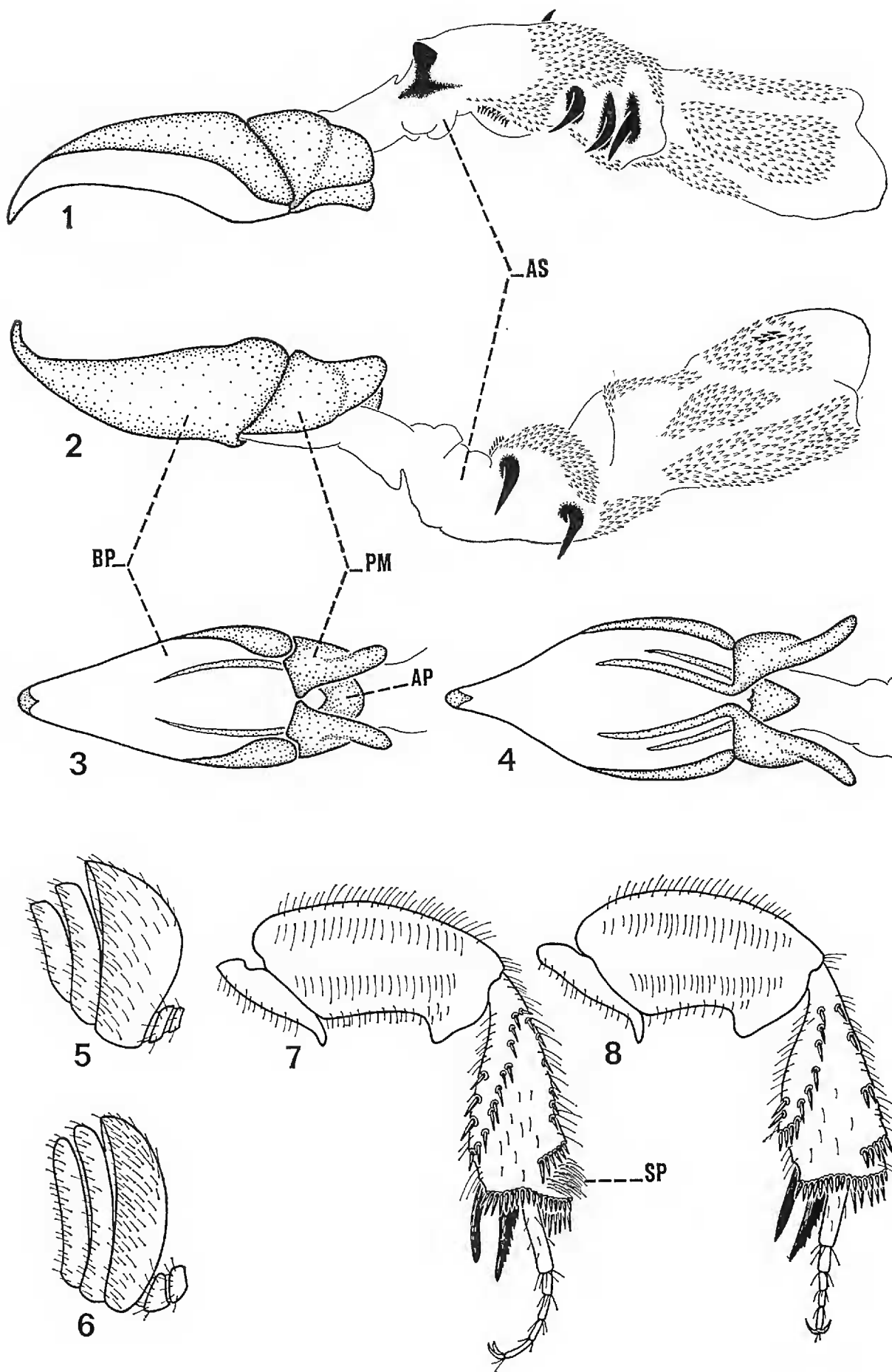
The genus *Pseudochodaeus* possesses the following combination of characters which distinguishes it from *Ochodaeus* Serville: single elytral stria, pectinate metatibial spur, absence of a stridulatory peg, enlarged and cupped eighth antennal segment, unmodified propygidium, elongate elytra not modified at the apical sutural angle, and produced metatrochanters. In *Ochodaeus* the eighth antennal segment is not cupped (Fig. 6) and the parameres of the male genitalia each possess an elongate basal process (Fig. 4). It should be noted that at least one species now placed in the genus *Ochodaeus* lacks a stridulatory peg (Carlson, 1975).

The genus *Pseudochodaeus* is of particular interest because it has characters in common with other Ochodaeinae such as *Ochodaeus*, *Codocera* Eschscholtz, and *Chaetocanthus* Péringuey, and with *Pachyplectrus* LeConte, now placed in the Hybosorinae. *Chaetocanthus* is known only from South Africa and differs from *Pseudochodaeus* in having bidentate foretibia, 9-segmented antennae with the eighth segment not enlarged, and pectinate tibial spurs on all legs. *Chaetocanthus*, however, has elytra with only one stria, a tranverse and non-emarginate labrum, and lacks the stridulatory peg.

VanDyke (1904) and Fall (1904) mentioned that a new species of *Ochodaeus*, presumably *O. estriatus*, was similar in some ways to *Pachyplectrus laevis* LeConte. We have examined *P. laevis* and find several similarities to *Pseudochodaeus* and other genera in the Ochodaeinae. The male genital apparatus in *Pachyplectrus laevis* has a pointed basal piece, symmetrical parameres, and a well developed aedeagal sac, characters shared by *Pseudochodaeus*, *Ochodaeus*, *Codocera*, and *Chaetocanthus* (Carlson, 1975). The eighth abdominal spiracle of *Pachyplectrus laevis* is located in the tergites and the seventh is adjacent to, but not surrounded by the tergite. In the Ochodaeinae both the seventh and eighth abdominal spiracles are in the tergites, however, in *Pseudochodaeus* the seventh spiracle is close to the edge of the tergite. In *Ochodaeus*

→

FIGS. 1-8. Fig. 1. Male genitalia of *Pseudochodaeus estriatus* (Schaeffer), right lateral view. AS, aedeagal sac. Fig. 2. Male genitalia of *P. estriatus* (Schaeffer), left lateral view. AS, aedeagal sac; BP, basal piece; PM, parameres. Fig. 3. Male genitalia of *P. estriatus* (Schaeffer), dorsal view. AP, V-shaped apophysis; BP, basal piece; PM, parameres. Fig. 4. Male genitalia of *Ochodaeus praesidii* Bates, dorsal view. Fig. 5. Antennal club of *P. estriatus* (Schaeffer), dorsal view. Fig. 6. Antennal club of *Ochodaeus pectoralis* LeConte, dorsal view. Fig. 7. Female, hind leg of *P. estriatus* (Schaeffer), ventral view. SP, setal patch. Fig. 8. Male, hind leg of *P. estriatus* (Schaeffer), ventral view.



the seventh spiracle is well within the tergite. *Pachyplectrus laevis* lacks pectinate tibial spurs and the stridulatory peg.

Examination of several other genera in the Hybosorinae (*Hybosorus* MacLeay, *Phaeochrous* Laporte, and *Chaetodus* Westwood) has revealed that the male genital apparatus has a truncate basal piece and asymmetrical parameres. Also, according to Ritcher (1969 a, b), only the eighth abdominal spiracle of these genera is located in the tergites.

On the basis of the characters we have examined, it appears that *Pachyplectrus* is an intermediate form and the limits of the Ochodaeinae and Hybosorinae may need to be reevaluated. A final decision on this will have to await a more extensive study of the morphology of *Pachyplectrus* and examination of *Synochodaeus* Kolbe and *Enodognathus* Benderitter, two other genera in the Ochodaeinae.

PSEUDOCHODAEUS ESTRIATUS (Schaeffer) New Combination  
(Figures 1-3, 5, 7-9)

*Ochodaeus estriatus* Schaeffer, 1906, p. 271.

TYPE MATERIAL.—Holotype: Female. In the NMNH. Data on labels: California, Fresno County, Millwood; Holotype; *estriatus* Schaeff.; Property of Mark Robinson; M. Robinson collection 1959. We have examined the holotype and find it is missing one hind leg and one antenna, but is otherwise intact. It is 9.0 mm in length and 4.2 mm in width through the midpoint of the elytra.

DESCRIPTION. *Males*.—Length 5.7 mm to 9.5 mm, width through midpoint of elytra 2.7 mm to 4.6 mm. Color light brown to dark reddish-brown. Vertex, pronotal disc, scutellum, and elytra covered with relatively short, yellow, semi-erect setae. Margins of pronotum and elytra with longer yellow setae. Mandibles distinctly angulate on outer margins, not evenly convex. Left mandible bidentate with large prosthema and basal molar areas; secondary tooth broad, not pointed. Right mandible bidentate with large prosthema and molar area; secondary tooth bluntly pointed. Labrum densely setose, nearly obscured by setae, dorsal surface simple. Mentum subquadrate, shallowly emarginate anteriorly, with shallow, median, longitudinal impression; setose on each side of median impression. Anterior clypeal margin reflexed, forming tubercle at center; clypeus setose. Frons impressed medially, setose and punctate, setae arising from punctures, anterior edge of punctures slightly elevated; median area of vertex sparsely punctate and lacking setae; posterior-lateral areas of vertex setose and punctate. Pronotum convex, with median longitudinal impression; disc evenly setose, each seta arising from puncture. Scutellum setose and punctate. Surface of each elytron densely setose; setae arising from punctures. Apical sutural angle of elytra simple, not dentiform. Foretibia with apical spur large, arcuate, and with apex enlarged. Mesotibia expanded laterally; outer spur pectinate; first tarsal segment longer than next three segments together. Metafemur with large tooth on posterior margin at apical one-third (Fig. 8). Metatibia expanded laterally (Fig. 8); oblique row of spines running from base to inner margin at distal one-third; subapical oblique row of spines at outer margin; outer apical angle between subapical row of

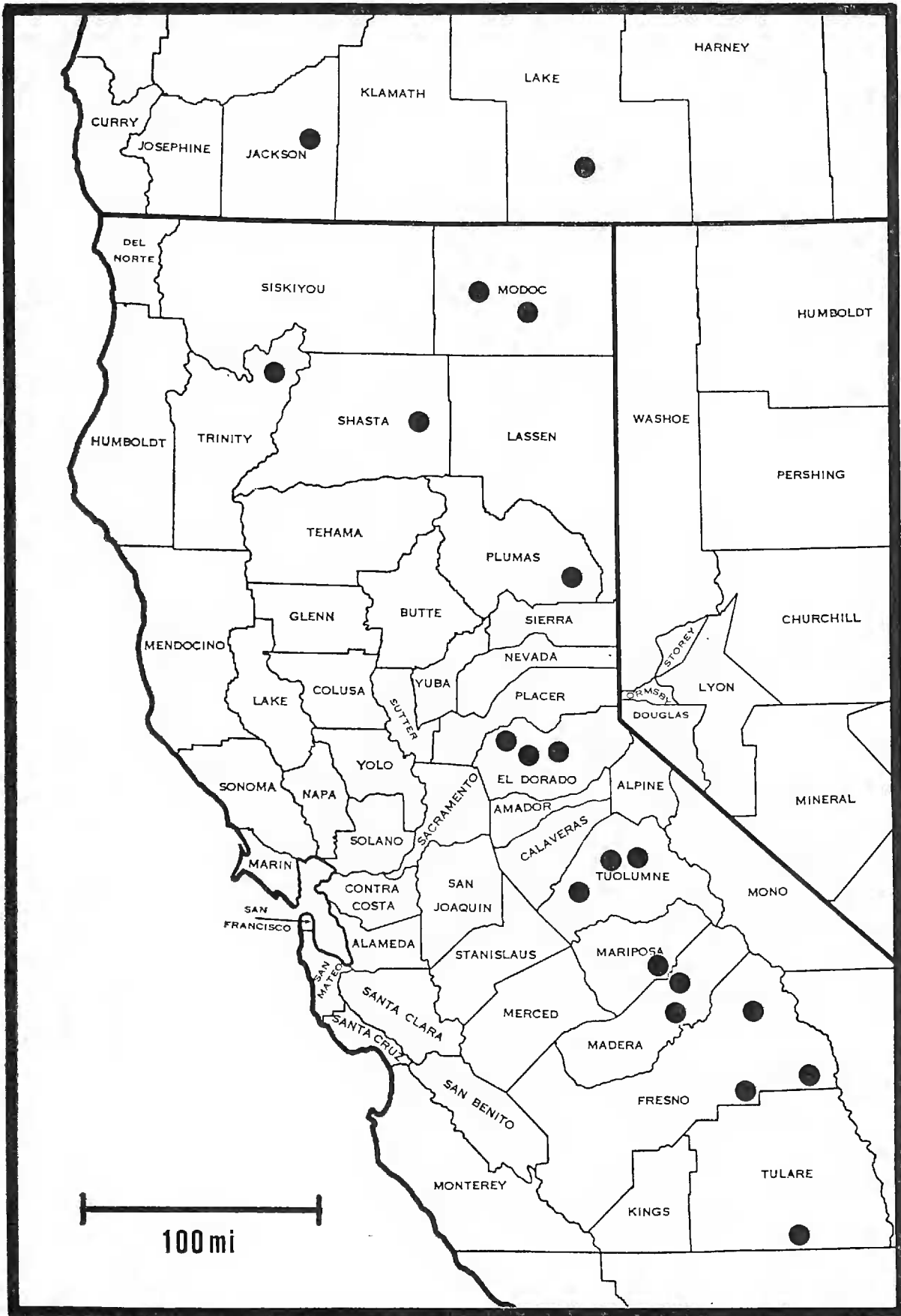


FIG. 9. Distribution of *Pseudochodaesus estriatus* (Schaeffer) in California and Oregon, U. S. A.

spines and apex sparsely setose; outer spur pectinate; first tarsal segment longer than next three segments together. Male genitalia (Figs. 1-3): aedeagal sac with 1 basal sclerotized structure and 5 to 7 large, sclerotized spines; distal two-thirds of sac covered with irregularly arranged patches of pigmented spiculi. V-shaped apophysis with distal margin rounded.

FEMALES.—Length 5.8 mm to 9.3 mm, width through midpoint of elytra 2.9 mm to 4.3 mm. Other characters same as males except that the outer apical angle of the metatibia bears a dense patch of setae (Fig. 7).

DISTRIBUTION (FIG. 9) AND SPECIMENS EXAMINED (holotype, 41 ♂, 49 ♀). CALIFORNIA: *El Dorado County*: 2 ♀, July 1932, F. T. Scott (KU); 4 ♂, 4 ♀, Pacific House, July—3 August 1931, H. Hinton (CAS); 1 ♂, Snowline Camp, 20 July 1948, P. D. Hurd (UCB); 1 ♂ Riverton, August 1930, H. Hinton (CAS); 1 ♀, Pollock Pines, 25 July 1938, A. T. McClay (ASU); 1 ♂, nr. Whitehall, 21 July 1931, H. Hinton (NMNH); 1 ♀, Garden Valley, 4 July 1965 (ARH). *Fresno County*: 1 ♂ 2 ♀, vic. Wishon, 15 August 1971, D. Marqua (PHS); 1 ♀, vic. Wishon, 6 August 1971, F. T. Hovore (ORSU); 1 ♂, Cedar Grove, Kings River Cyn, 17 July 1952, Cazier, Gertsch, Schrammel (AMNH); 1 ♂, Huckleberry Meadow, 6500', August 1912 (CAS); 1 ♂, Camp Greeley, 2800', 25 July (CAS); 1 ♂, Millwood (NMNH). *Madera County*: 1 ♂, Sugar Pine, 21 July 1933, R. P. Allen (CAS); 1 ♂, Placer Ranger Station, NE Northfork, 30 July 1931 (CAS); 1 ♀, Miami Ranger Station, 10 mi N Oakhurst and S of Yosemite Nat. Park, 24 June 1938 (CAS). *Mariposa County*: 1 ♀, Miami Ranger Station, 4000', 29 June 1946, H. P. Chandler (CAS). *Modoc County*: 1 ♀, Hackamore, 17 July 1934, O. H. Schwab (CAS); 2 ♂, Pitt River, May (CAS). *Plumas County*: 1 ♀, Walker Mine, 25 July 1930, E. F. Wohletz (CAS); 1 ♀, S end of Red Clover Valley, 8 mi N Beckworth, 28 August 1963, H. B. Leech (CAS). *Shasta County*: Hat Creek: 1 ♀, July 1948, A. S. Perry (UCB); 1 ♀, 16 July 1951, G. Pronin (CAS); 1 ♂, 20 July 1951, G. Pronin (CAS); 2 ♂, 27 July 1951, G. Pronin (CAS); 1 ♂, 25 August 1951, G. Pronin (CAS); 1 ♀, 25 August 1952, G. Pronin (CAS); 1 ♂, 12 July 1955, J. W. MacSwain (UCB); 1 ♀, 19 July 1955, G. Pronin (CAS); 1 ♂ 1 ♀, 29 July 1971, D. Carlson (DCC). *Trinity County*: 1 ♂, Carrville, 6 July 1950, D. Guiliani (CAS). *Tulare County*: 1 ♂, 2 mi E Posey, 21 August 1971, E. Giesbert (DCC). *Tuolumne County*: 1 ♂, trib. to Herring Creek, 1.5 mi N Pinecrest Lake, 30 August 1964, H. B. Leech (CAS); 1 ♀, Twain-Harte, 4000', July 1937, Blaisdell (CAS); 1 ♀, Strawberry Resort, 5243', 8 August 1937, E. Herald (CAS); 1 ♂, Strawberry, 15 August 1962, C. A. Toschi (UCB). OREGON: *Jackson County*: Fourbit Ford Cmpgnd., 11 mi SE Butte Falls: 4 ♂ 5 ♀, 18 July 1973, P. O. Ritcher and D. C. Carlson (ORSU, DCC); 8 ♂ 10 ♀, 9 August 1973, D. C. Carlson and W. N. Mathis (ORSU, DCC, NMNH); 3 ♂ 9 ♀, 29 August 1973, D. C. Carlson and R. L. Westcott (ORSU, DCC, RLW, HFH); 1 ♀, Jct. Rd 3520 and S. Fork Fourbit Creek, 11 mi SE Butte Falls, 29 August 1973, D. C. Carlson and R. L. Westcott (ORSU). *Lake County*: 1 ♂, Warner Canyon, 31 July 1968, R. L. Westcott (RLW).

REMARKS.—The color variation of the adults of *P. estriatus* is apparently a result of age. Specimens which we collected on 18 July 1973 were light brown with the setation intact and legs unabraded. Later

collections at the same site (9 and 29 August 1973) yielded all dark reddish-brown specimens which were quite worn.

This species has also been recorded from Deschutes County, Oregon (Hatch, 1971), but we have been unable to verify the record. *Ochodaeus simplex* LeConte is the only *Ochodaeus* we and others have collected in Deschutes County.

We have visited four of the localities where *P. estriatus* occurs and have collected specimens at two of them (Fourbit Ford Campground, Jackson Co., Oregon and Hat Creek, Shasta Co., California). All of these are forested areas with sparse ground cover of shrubs and grass and all are close to streams. At Fourbit Ford Campground the following plant species were fairly abundant: *Pseudotsuga menziesii* (Mirb.), *Pinus ponderosa* Laws., *Abies grandis* (Dougl.), *Quercus kelloggi* Newb., *Holodiscus discolor* (Pursh), *Ceanothus integerrimus* Hook and Arm., *Amelanchier florida* Lindl., *Symphoricarpos albus* (L.), *Mahonia* sp., and *Corylus* sp. Bracken fern and sparse grass were also present.

Included with the holotype which we borrowed from the NMNH was another specimen bearing a handwritten locality label identical to that with the holotype. This specimen is a male and we believe it to be the misplaced specimen which Schaeffer referred to in the original description of *O. estriatus*.

We are depositing specimens of *P. estriatus* from Oregon, including males with everted aedeagal sacs, in the NMNH and collection of H. F. Howden, Carleton University, Ottawa, Ontario, Canada.

#### BIOLOGY AND IMMATURE STAGES

Information on the biology of the Ochodaeinae is exceedingly scanty, which is surprising since the adults are often abundant. About all that has been known of the adults is that they fly at night, are attracted to light, and burrow in the soil.

By dissection, we have determined that the mid- and hindgut of *P. estriatus* adults often contain numerous small spores of a basidiomycete similar to those of puff balls. The female reproductive system has 6 ovarioles in each ovary but only 1 egg develops at a time on each side. A typical fully developed egg is white, elongate-oval in shape, 2.78 mm long, and 1.44 mm wide. This is quite large for such a small beetle.

Like other Ochodaeinae, the flight period of *P. estriatus* is quite long. Adults were taken at light in southern Oregon from July 18 to August 29, 1973. Dissection indicated that egg development proceeds slowly and that the few eggs are laid over a long period of time.

While digging for *Pleocoma* LeConte larvae in southern Oregon in 1961, David Fellin, then a graduate student, obtained a small scarabaeid larva with 4-segmented antennae, which was unlike any other with which the junior author was familiar. He suspected it to be an *Ochodaeus* since he was familiar with the larvae of all scarab genera occurring in Oregon except those of *Glaresis* Erichson, *Bolborhombus* Cartwright, and *Ochodaeus*. *Glaresis* was eliminated because of its very small size and *Bolborhombus* because larvae of related Geotrupinae all have 3-segmented antennae.

The main problem with this tentative identification was that adult *Ochodaeus* had never been collected in southern Oregon west of the Cascade Mountains. In recent years, a number of unsuccessful attempts were made to collect *Ochodaeus* adults at black-lights in southern Oregon, in the vicinity of Butte Falls. Finally, on 18 July 1973 we took 9 adults (4 ♂, 5 ♀) of *Pseudochodaeus estriatus* (Schaeffer), 11 miles southeast of Butte Falls. This site is less than a mile from where the supposed *Ochodaeus* larva was dug in 1961.

Medvedev (1960) described the larva of *Codocera ferruginea* Eschscholtz, a common Eurasian species of Ochodaeinae, based on 2 unassociated larvae collected in the soil of a Ukrainian tree plantation. Unfortunately, characters of the epipharynx, mandibles, and maxillae were neither described nor figured and we were unable to borrow the specimens for study.

At first, we assumed our *Ochodaeus* larva differed from Medvedev's *Codocera* larva because they belonged in different genera. However, Medvedev's larva could well be a *Trox* Fabricius since it resembles that genus in the type of head setation, in having 3-segmented antennae, and in having fleshy anal lobes.

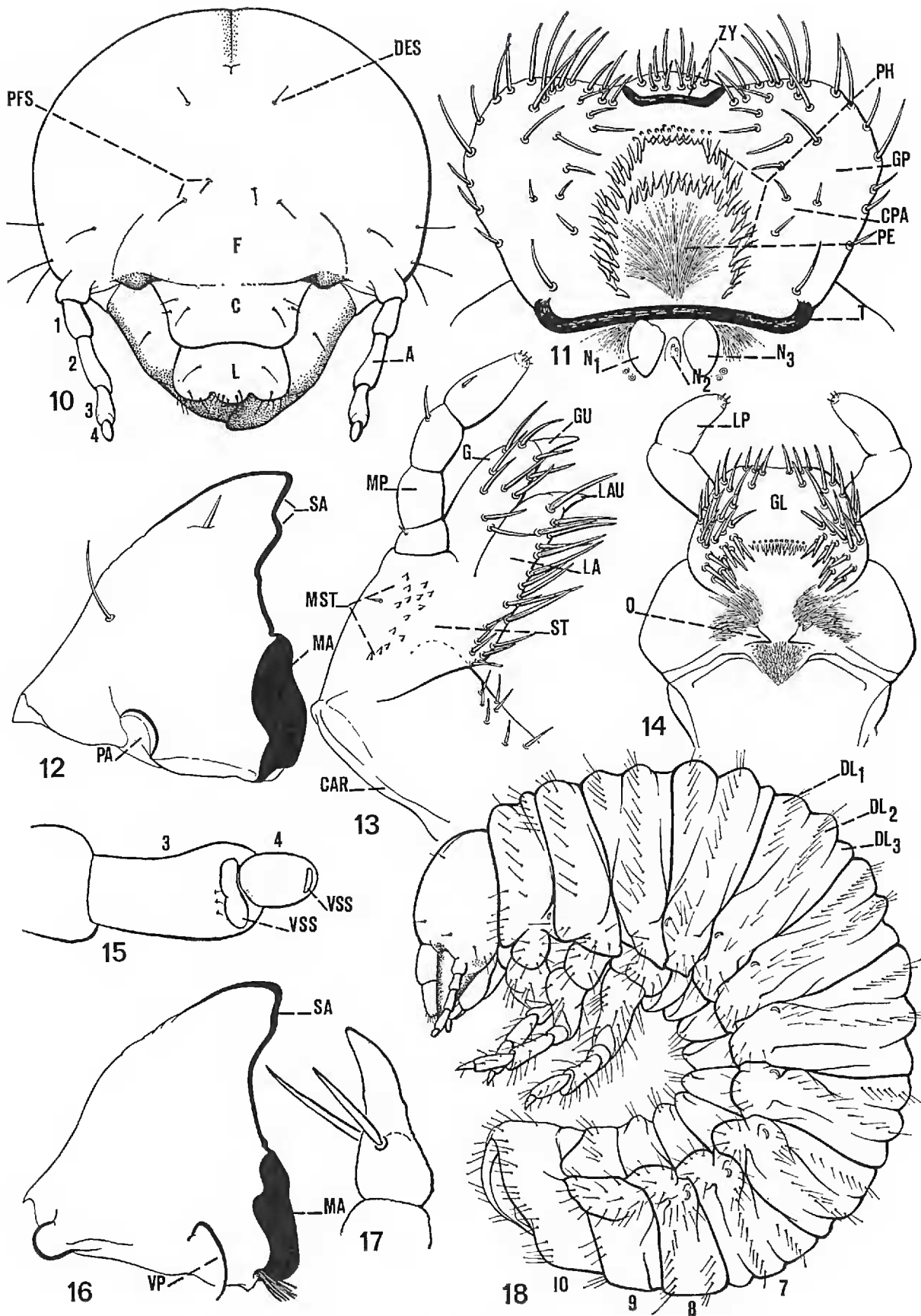
PSEUDOCHODAEUS ESTRIATUS (Schaeffer), Third-Stage Larva  
(Figures 10-20)

Description based on one third-stage larva collected from the soil 10 miles east of Butte Falls, Jackson County, Oregon, 28 January 1961, by David Fellin.

→

FIGS. 10-18. Larva of *Pseudochodaeus estriatus* (Schaeffer). Fig. 10. Head. A, antenna; C, clypeus, DES, dorsoepicranial seta; F, frons; L, labrum; PFS, posterior frontal setae. Fig. 11. Epipharynx. CPA, chaetoparia; GP, gymnoparia; NI-3, nesia; PE, pedium; PA, phobae; ZY, zygum. Fig. 12. Left mandible. PA, preartis; MA, molar area; SA scissorial area (upper surface). Fig. 13. Right maxilla (lower surface). CAR, cardo; G, galea; GU, uncus of galea; LA,





lacina; LAU, uncus of lacinia; MST, maxillary stridulatory teeth. Fig. 14, Labium with hypopharynx. GL, glossa. Fig. 15. Last 2 segments of antenna (ventral surface). VSS, ventral sensory spot. Fig. 16. Right mandible (Ventral surface). MA, molar area. SA, scissorial area; VP, ventral process. Fig. 17. Claw of prothoracic leg. Fig. 18. Left lateral view of entire third-stage larva. DL1, DL2, DL3, dorsal lobes.

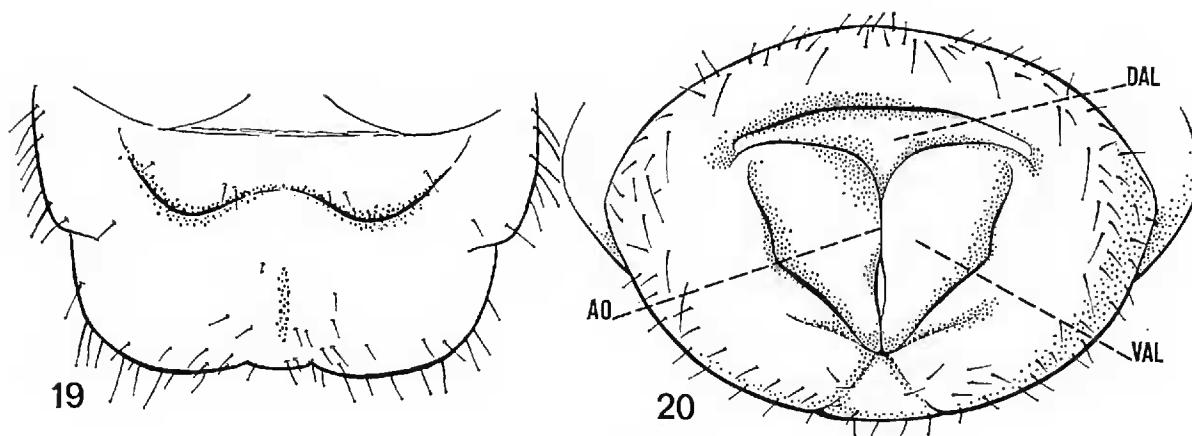
DESCRIPTION.—Larva typically scarabaeiform, C-shaped (Fig. 18). Head light yellow-brown, thorax and abdomen whitish.

Maximum width of head capsule (Fig. 10) 2.28 mm. Surface of head fairly smooth. Epicranial stem present, frontal sutures largely absent. With 1 dorso-epicranial seta on each side. Frontal area with pair of posterior frontal setae on each side, other frontal setae absent. Frontoclypeal suture mostly absent. Labrum trilobed. Antenna 4-segmented with distal segment reduced in size, distal segment less than half as long as third segment (Fig. 10). Ventral surface of next to last antennal segment (third) with 1 apical, elliptical sensory spot; last antennal segment also with similar ventral, apical spot (Fig. 15). Apex of last antennal segment with about 7 sensory pegs. Mandibles (Figs. 12 and 16) subtriangular in shape, each with 2 scissorial teeth and with typical ventral, accessory, articulating process. Maxilla (Fig. 13) with separate galea and lacinia. Maxillary stridulatory teeth consisting of a group of about 14 short, conical teeth. Maxillary palpus 4-segmented. Labium (Fig. 14) with symmetrical oncyli. Epipharynx (Fig. 11) with complete, symmetrical zygum. Pedium surrounded by phobae and with inner second group of phobae posterior to anterior phobae. Tormae fused, symmetrical, lacking either epitorma or pternotormae. Haptolachus with 3 nesia; 1 large sclerotized plate on each side and 1 small median sense cone. Chaetopariae with a few (10 to 11) strong chaetae on each side. Chaetopariae without microsensilla.

Abdominal segments 1-7 each with 3 dorsal lobes (Fig. 18). Anterior 2 dorsal lobes each with transverse row of setae, posterior dorsal lobe bare. Spiracles cribiform, inconspicuous, occurring on prothorax and first 8 abdominal segments. Prothoracic spiracle elliptical, with slight caudal emargination. Respiratory plates of abdominal spiracles all similar in size, crescent shaped, with caudo-ventral emarginations. Legs 4-segmented, each ending in well developed claw (Fig. 18): Claws similar in size, each bearing 2 setae (Figs. 17 and 18). Ventral surface of last abdominal segment (Fig. 19) with poorly developed raster. Raster consisting of a few (about 18) irregularly distributed, rather short, slender setae. Raster extending less than one-half the distance to seventh abdominal segment; anteriorly, with broad, bilobed raised area. Anal opening Y-shaped surrounded by narrow, transverse, dorsal anal lobe and 2 larger, subtriangular, lower anal lobes (Fig. 20).

REMARKS.—The larva of *P. estriatus* has a number of morphological characters indicating it belongs to the more primitive Scarabaeidae. These characters are similar to those of the less specialized scarabaeid subfamilies Troginae and Aphodiinae. It resembles larvae of *Trox* (sensu strictu) in lacking a well-developed fronto-clypeal suture, in having a haptolachus with 2 sclerotized plates and a median sense cone, and in the type of anal opening and surrounding lobes. It differs from *Trox* and *Omorgus* Erichson larvae, however, in having 4-segmented antennae (not 3 as in Troginae), a trilobed labrum (not bilobed), and a different type and arrangement of maxillary stridulatory teeth.

The larva of *P. estriatus* will key to Aphodiinae in Ritcher's 1966 monograph and in his 1967 paper. It can be distinguished readily



FIGS. 19 and 20. Larva of *Pseudochodaeus estriatus* (Schaeffer). Fig. 19. Ventral view of last (tenth) abdominal segment. Fig. 20, caudal view of last abdominal segment. AO, anal opening; DAL, dorsal anal lobe; VAL, ventral anal lobe.

from larvae of Aphodiinae by such characters as the incomplete frontoclypeal suture (Fig. 10), the complete zygum of the epipharynx (Fig. 11), and the absence of an epitorma (Fig. 11). It resembles larvae of Aphodiinae in that both have ventral, apical sensory areas on the last 2 antennal segments (Fig. 15).

Although nothing is known of the subterranean habits of the larva of *P. estriatus*, some inferences can be drawn from its morphology. The worn mandibles, well developed legs and claws, and body setation are all indicative of an active larva, not of a larva whose food was provisioned by the adult.

#### ACKNOWLEDGMENTS

We wish to thank the following for the generous loan of specimens: American Museum of Natural History (AMNH); Arizona State University, Tempe (ASU); California Academy of Sciences (CAS); Oregon State University (ORSU); National Museum of Natural History (NMNH); University of California, Berkeley (UCB); A. R. Hardy (ARH); F. T. Hovore (FTH); P. H. Sullivan (PHS); and R. L. Westcott (RLW). The letters in parentheses are the abbreviations used in the text for the collections from which we borrowed specimens. We are indebted to W. C. Denison, Oregon State University botanist, for identifying the basidiomycete spores. We also thank R. B. Roberts for many helpful suggestions and Mrs. B. Hall for assistance with the larval illustrations.

## LITERATURE CITED

- CARLSON, D. C. 1974. Taxonomic characters of the genus *Ochodaeus* Serville with descriptions of two new species in the *O. pectoralis* LeConte species complex (Coleoptera: Scarabaeidae). Bull. S. Calif. Acad. Sci., (in press).
- FALL, H. C. 1904. In: Proc. Pacific Coast Entomol. Soc., 1:22.
- HATCH, M. H. 1971. The beetles of the Pacific Northwest. Part V. Univ. Washington Press, Seattle, 662 pp.
- MEDVEDEV, S. I. 1952. Larvae of scarabaeoid beetles of the fauna of the USSR. Opredeliteli Faune USSR, Moscow, 47:1-343.
- MEDVEDEV, S. I. 1960. Descriptions of the larva of eight species of lamellicorn beetles from the Ukraine and Central Asia. Zool. Zhurn., 39:381-393.
- RITCHER, P. O. 1966. White grubs and their allies, a study of North American scarabaeoid larvae. Oreg. State Univ. Press, Stud. Entomol., 4:1-219.
- RITCHER, P. O. 1967. Keys for identifying larvae of Scarabaeoidea to the family and subfamily (Coleoptera). Calif. Dept. Agr. Occ. Papers, 10:1-8.
- RITCHER, P. O. 1969a. Spiracles of adult Scarabaeoidea (Coleoptera) and their phylogenetic significance. I. The abdominal spiracles. Ann. Entomol. Soc. America, 62(2):869-880.
- RITCHER, P. O. 1969b. Spiracles of adult Scarabaeoidea (Coleoptera) and their phylogenetic significance. II. Thoracic spiracles and adjacent sclerites. Ann. Entomol. Soc. America, 62(6):1388-1398.
- VANDYKE, E. C. 1904. In: Proc. Pacific Coast Entomol. Soc., 1:22.